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LIMBACH & LIMBACH L.L.P.
2001 Ferry Building, San Francisco, CA 94111
415/433-4150

Address to:
Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

Attorney's Docket No. SUGI-T0764

First Named Inventor NOBORU FUJII

UTILITY PATENT APPLICATION TRANSMITTAL
(under 37 CFR 1.53(b))

SIR:

Transmitted herewith for filing is the patent application entitled:
COMMUNICATION METHOD, TRANSMITTING APPARATUS, AND RECEIVING APPARATUS

CERTIFICATION UNDER 37 CFR § 1.10

I hereby certify that this New Application and the documents referred to as enclosed herein are being deposited with the United States Postal Service on this date June 28, 2000, in an envelope bearing "Express Mail Post Office To Addressee" Mailing Label Number EL254155350US addressed to: Box Patent Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

Elizabeth Reicker — Elizabeth Reicker
(Name of person mailing paper) (Signature)

Enclosed are:

1. X Transmittal Form (two copies required)

2. The papers required for filing date under CFR § 1.53(b):
   i. 17 Pages of specification (including claims and abstract);
   ii. 3 Sheets of drawings.
   x formal __ informal

3. Declaration or oath
   a. x Unsigned

ACCOMPANYING APPLICATION PARTS

4. __ An assignment of the invention to Sony Corporation and JSAT Corporation is attached (including Form PTO-1595).

   i. __ 37 CFR 3.73(b) Statement (when there is an assignee)

5. x Power of Attorney (unsigned)

6. __ An Information Disclosure Statement (IDS) is enclosed, including a PTO-1449 and copies of __ references.

7. __ Preliminary Amendment.

8. X Return Receipt Postcard (MPEP 503 -- should be specifically itemized)

9. FOREIGN PRIORITY
   [x] Priority of application no. P11-186493 filed on June 30, 1999 in Japan is claimed under 35 USC 119.

   The certified copy of the priority application:
   x is filed herewith; or
   _ has been filed in prior application no. _ filed on _, or
   _ will be provided.

   __ English Translation Document (if applicable)

10. **FEE CALCULATION**

a. __ Amendment changing number of claims or deleting multiple dependencies is enclosed.

CLAIMS AS FILED

	Number Filed	Number Extra	Rate	Basic Fee ($690)
Total Claims	10 - 20	* 0	x $18.00	0
Independent Claims	3 - 3	* 0	x $78.00	0
x Multiple dependent claim(s), if any			$260.00	260.00

*If less than zero, enter "0".

Filing Fee Calculation $950.00

50% Filing Fee Reduction (if applicable) . . . . . $

11. Small Entity Status
a. __ A small entity statement is enclosed.
b. __ A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
c. __ is no longer claimed.

12. Other Fees
__ Recording Assignment [$40.00] $0
__ Other fees
Specify _____ $0

Total Fees Enclosed $950.00

13. Payment of Fees
x Check(s) in the amount of $ 950.00 enclosed.
__ Charge Account No. 12-1420 in the amount of $__.
A duplicate of this transmittal is attached.

14. All correspondence regarding this application should be forwarded to the following attorney:

Charles P. Sammut
Limbach & Limbach L.L.P.
2001 Ferry Building
San Francisco, CA 94111
Telephone: 415/433-4150
Facsimile: 415/433-8716

15. Authorization to Charge Additional Fees

X The Commissioner is hereby authorized to charge any additional fees (or credit any overpayment) associated with this communication and which may be required under 37 CFR § 1.16 or § 1.17 to Account No. 12-1420. A duplicate of this transmittal is attached.

LIMBACH & LIMBACH L.L.P.

June 28, 2000
(Date)

By: _____
Mayumi Maeda
Registration No. 40,075
Attorney(s) or Agent(s) for Applicant(s)

Attorney Docket No. SUGI-T0764
[S00P0764US00]

BY EXPRESS MAIL NO. EL254155350US
Attorney Docket No. SUGI-T0764

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application for Letters Patent

Title : COMMUNICATING METHOD, TRANSMITTING APPARATUS, AND RECEIVING APPARATUS

Inventor(s): Noboru FUJII
Kazuhiro HARA
Hidetaka IZUMIYAMA

COMMUNICATING METHOD, TRANSMITTING APPARATUS, AND RECEIVING APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

The invention relates to a communicating method, a transmitting apparatus, and a receiving apparatus, in which a unidirectional communication medium such as a digital broadcasting is made to look like a bidirectional communication medium, thereby making it possible to perform a path control in which a bidirectional communication medium is used as a prerequisite.

Description of the Related Art

For example, communication using a communication satellite or a partial CATV as a medium is a unidirectional communication and an application, a communication protocol, and the like on a satellite broadcasting have been designed in consideration of a unidirectional topology. In recent years, a method of sending a packet of an IP (Internet Protocol) to a satellite network has been tried in association with the spread of the Internet.

The application on the Internet, however, has been usually developed in consideration of only the bidirectional communication medium such as Ethernet, FDDI (Fiber Distributed Interface: optical LAN of 100 Mbps), or the like. Therefore, under an environment

using the unidirectional communication medium like a satellite broadcasting, if the application used on the Internet is used, such a trouble that the communication cannot be properly performed occurs.

When a router is connected to a satellite line, since a path control program operating at present on the router has been designed on the assumption that the line to which the router is connected is a bidirectional communication medium, a problem occurs. A path control packet transmitted by a certain router has to directly arrive at an interface of an adjacent router connected to the same segment as that of an interface to which such a router generated the packet. Since the satellite line is unidirectional, however, although a packet can be sent from the transmitting side to the receiving side via the satellite line, a packet cannot be transmitted from the receiving side to the transmitting side via the satellite line. Since the router cannot bidirectionally communicate via the satellite line, the communication using the satellite line cannot be correctly performed. In the case where the unidirectional communication medium like a satellite line is used as mentioned above, a problem occurs in the communication of the router or node on which the path control program operates.

OBJECT AND SUMMARY OF THE INVENTION

It is, therefore, an object of the invention to provide a communicating method whereby when a unidirectional communication medium is used, a router or node on which a path control program operates is enabled to virtually and bidirectionally communicate via the communication medium and to provide a transmitting apparatus and a receiving apparatus for realizing such a communicating method.

To accomplish the above object, according to a preferred aspect of the invention, there is provided a communicating method in a network in which a feed and receivers are connected via a unidirectional line and the feed and the receivers are respectively connected to a bidirectional line via routers, comprising the steps of:

allowing a first router to transmit a first packet including path control information to a first receiver;

allowing the first receiver to transmit a second packet obtained by capsulating the first packet to a first interface of the feed via the first router, the bidirectional line, and a second router;

allowing the feed to extract the first packet by decapsulating the second packet, transmit the first packet to the second router from a second interface, and transmit the first packet to a third receiver from a third interface via the unidirectional line; and

allowing the third receiver to transmit the first packet to a third router.

According to another aspect of the invention, there is provided a transmitting apparatus having first, second, and third interfaces, wherein the transmitting apparatus:

is connected to a first interface of a router via the first interface and a bidirectional line;

is connected to a second interface of the router via the second interface and the bidirectional line;

is connected to a receiver via the third interface and a unidirectional line;

receives a capsulated packet including path control information via the bidirectional line, the router, and the first interface from the receiver;

decapsulates the capsulated packet, transmits the path control information extracted due to the decapsulation to the router via the second interface and the bidirectional line, and transmits the path control information to the receiver via the third interface and the unidirectional line.

According to further another aspect of the invention, there is provided a receiving apparatus having first and second interfaces, wherein the receiving apparatus:

is connected to a feed via the first

interface and a unidirectional line;

is connected to a bidirectional line via the second interface and a router;

receives a packet including path control information from the router via the second interface;

capsulates the received packet and transmits the capsulated packet to the feed via the second interface, the router, and the bidirectional line; and

receives path information from the feed via the unidirectional line and the first interface.

According to the invention, each of the feed and receiver has the unidirectional line and the interface for connecting to the router, the feed has the decapsulating function, and the receiver has the capsulating function, so that the unidirectional line can be made to look like a bidirectional line and a path control can be performed without a trouble.

The above and other objects and features of the present invention will become apparent from the following detailed description and the appended claims with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing a form of a network in an embodiment of the invention;

Fig. 2 is a block diagram for explaining communication of a packet including path control

information in the embodiment of the invention;

Fig. 3 is a diagram schematically showing a construction of the packet; and

Fig. 4 is a diagram schematically showing the construction of the packet which is transmitted via a satellite line.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the invention will now be described hereinbelow with reference to the drawings. Fig. 1 shows a topology (form) of a network of the embodiment. A unidirectional communication medium, for example, a satellite line 1 and a bidirectional communication medium, for example, a ground line 2 exist as communication media. In the embodiment, communication of an IP (Internet Protocol) packet can be performed via the satellite line 1.

As is well known, a layer structure of TCP/IP comprises a network interface layer, an Internet layer, a transport layer, and an application layer. The network interface layer corresponds to a physical layer and a data link layer in an OSI reference model. A protocol of the physical layer transmits and receives a packet by a packet. The Ethernet corresponds to the physical layer and the data link layer. An IP is included in the Internet layer. The IP determines a path on the basis of the received IP address. The IP

adds an IP header. A large quantity of information such as IP addresses of a transmission host and a reception host and the like is included in the IP header. An address conversion between an Ethernet address and an IP address is performed between the network interface layer and the Internet layer.

A feed 3 as a transmitter and receivers 4 and 5 as receiving apparatuses are connected to the satellite line 1 and ground line 2. Although one feed and two receivers are connected in the example of Fig. 1, more feeds and receivers can be connected. More specifically speaking, the satellite line 1 is constructed by a transmitting antenna, a satellite (communication satellite or broadcasting satellite), a receiving antenna, and the like. More specifically speaking, the ground line 2 is constructed by a B-ISDN (Broadband-ISDN), a high speed digital exclusive line, an N-ISDN (Narrowband-ISDN), or an analog telephone network. The receivers 4 and 5 are enabled to have a function for receiving the satellite broadcast in addition to the function as a receiver for data communication.

The feed 3 has a third interface for connecting to the satellite line 1 in addition to first and second interfaces for connecting to the ground line 2 (router). The receivers 4 and 5 have the first interface for connecting to the satellite line 1 and

the second interface for connecting to the ground line 2 (router). The feed 3 and receivers 4 and 5 are apparatuses of the bridge type and each of them relays the packet received from one interface to the other interface. The feed 3 and receivers 4 and 5 are connected to the ground line 2 via the interfaces and routers 6, 7, and 8, respectively.

Each of the routers 6, 7, and 8 relays the packet on the ground line 2. An LAN (Ethernet, ATM (Asynchronous Transfer Mode)-LAN, etc.) is connected to each of the routers 6, 7, and 8. A path control program which is specified by the IP is equipped for the routers 6, 7, and 8 and path control information is processed on the basis of such a program, and a path control such as to decide a communication path of the packet or the like is performed.

As mentioned above, in the case where the satellite line 1 as a unidirectional line and the ground line 2 as a bidirectional line mixedly exist, since the path control program which operates in the routers 6 to 8 does not correctly operate, a method of making the satellite line 1 look like a bidirectional communication medium needs to be devised. This method is called a UDLR (Uni-Directional Link Routing).

The UDLR in case of applying the invention to a network topology similar to Fig. 1 will now be described with reference to Fig. 2. In the routers 6

to 8, the path control program operates and the path control information is exchanged between the adjacent routers. The router 6 connected to the feed 3 transfers the path control information to the routers 7 and 8 via the satellite line 1. In case of the client server type system, a server 11 is connected to the router 6 and client machines 12 and 13 are connected to the routers 7 and 8, respectively. Generally, since the path control program has been designed on the assumption that the line is bidirectional, the path control information is sent to the satellite line side from the routers 7 and 8. That is, the path control packet is sent to one interface of each of the receivers 4 and 5 from the routers 7 and 8, respectively.

Fig. 3 shows a path control packet (1) which is sent from the routers 7 and 8 to the receivers 4 and 5. In the packet (1), an MAC (Media Access Control) header is added to the head, an IP header is subsequently added, and the path control information is located after that. The MAC header has a length of, for example, 14 bytes and a transmitting source address of 6 bytes, a destination address of 6 bytes, and information showing a type of packet of 2 bytes are included. Those addresses are physical addresses on the LAN, for example, on the Ethernet. An IP address of a transmitting source (for example, client machine

12), an IP address of a destination (server 11), and the like are included in the IP header.

For example, the path control information packet (1) sent from the router 7 is received by one interface of the receiver 4. Since the receiver 4 cannot send the packet to the satellite line 1, the receiver capsulates the received path control information packet (1) to the IP packet and transmits a capsulated IP packet (2) to the first interface of the feed 3 from one interface via the router 7, ground line 2, and router 6. As shown in Fig. 3, the packet (2) is obtained by capsulating the IP header and path control information of the packet (1) as a path control packet.

When the feed 3 receives the packet (2) by the first interface, this feed decapsulates the IP packet, extracts a path control packet (3), and sends the path control packet (3) to the router 6 from the second interface. At the same time, the feed 3 sends the path control information extracted at the time of decapsulation to the satellite line 1 via the third interface. As shown in Fig. 3, the path control packets (1), (3), and (4) have the same packet construction.

When the packet (4) is transmitted via the satellite line 1, it is transmitted in a form of, for example, a section table of MPEG. Fig. 4 shows a packet construction of a table in case of transmitting

the packet (4) via the satellite line 1. A header of 24 bytes is located at the head, a payload of a variable length is subsequently located, and a CRC (4 bytes) for error detection is finally added. A packet of the packet (4) is inserted as a payload. The packet shown in Fig. 4 is divided into a transport packet and transmitted via the satellite line 1. A transmitting source MAC address, a destination MAC address, and the like are included in the header.

The router 6 receives the path control packet (3) by one interface. When the router 6 receives this packet, it processes the packet as if the path control information from the router 7 reached via the satellite line 1.

When the packet (4) transmitted via the satellite line 1 is received by the receiver 5 via one interface, the receiver 5 transmits the packet (4) received from the other interface as a packet (5) to the router 8. As shown in Fig. 3, the packet (4) and the packet (5) have the same packet construction. When the router 8 receives the packet (5) by one interface, it processes the packet as if the path control information from the router 7 reached via the satellite line 1.

As mentioned above, by the communication via the ground line 2, the network application such as a path control program on the router can be used as it is

by using the satellite line 1 as a bidirectional communication medium. Communication is performed between the feed 3 and the receiver 4 and/or 5 via the communication path established according to the path control information. As a kind of this communication, bidirectional communication by a unicast, multipoint communication by an IP multicast, or the like is possible. This communication is performed via the unidirectional line 1 or bidirectional line 2 on the basis of the path control information.

Other several systems have been proposed as systems of UDLR. In an IETF (Internet Engineering Task Force), a model in which the router itself having the interface of the unidirectional line performs the capsulation and decapsulation and the same function as the operation of the invention is provided.

According to this method, however, since the UDLR also needs to operate on the router by which the path control protocol operates, use efficiency of the user deteriorates. For example, in the invention, by separating the operation of the path control protocol of the router and the function of the UDLR, the router which can be used by the user is not limited. However, in the case where the UDLR is realized on the router, the function of the router to be used is influenced by the specifications of the apparatus. It is usually convenient if the function of the router itself and the

function for making the unidirectional line look like a pseudo bidirectional line by the UDLR are separated.

Although the satellite line has been mentioned as an example of the unidirectional line in the above description, the invention is not limited to it. For instance, the invention can be applied to a unidirectional line by a CATV (Cable Television) or a ground wave.

An interface which can set the feed and monitor a status can be also added independently of the first, second, and third interfaces of the feed. Security of the apparatus can be improved by providing another interface different from that of the processing system of the other IP packet.

According to the invention as described above, the router or node on which the path control program operates can virtually and bidirectionally perform communication via the unidirectional communication medium like a satellite line. Therefore, the path control is not obstructed by the path control program designed on the assumption that the bidirectional line is used.

The present invention is not limited to the foregoing embodiment but many modifications and variations are possible within the spirit and scope of the appended claims of the invention.

WHAT IS CLAIMED IS:

1. A communicating method in a network in which a feed and receivers are connected via a unidirectional line and the feed and the receivers are respectively connected to a bidirectional line via routers, comprising the steps of:

allowing a first router to transmit a first packet including path control information to a first receiver;

allowing said first receiver to transmit a second packet obtained by capsulating said first packet to a first interface of said feed via said first router, said bidirectional line, and a second router;

allowing said feed to extract said first packet by decapsulating said second packet, transmit said first packet to said second router from a second interface, and transmit said first packet to a third receiver from a third interface via said unidirectional line; and

allowing said third receiver to transmit said first packet to a third router.

2. A method according to claim 1, further comprising the step of performing communication between said feed and said receiver via a communication path established according to said path information.

3. A method according to claim 1, wherein said first and second packets are IP packets.

4. A method according to claim 1, wherein said unidirectional line is a satellite line.

5. A transmitting apparatus having first, second, and third interfaces, wherein the transmitting apparatus:

is connected to a first interface of a router via said first interface and a bidirectional line;

is connected to a second interface of the router via said second interface and said bidirectional line;

is connected to a receiver via said third interface and a unidirectional line;

receives a capsulated packet including path control information via said bidirectional line, said router, and said first interface from said receiver;

decapsulates said capsulated packet, transmits said path control information extracted due to the decapsulation to said router via said second interface and said bidirectional line, and transmits said path control information to the receiver via said third interface and said unidirectional line.

6. A receiving apparatus having first and second

interfaces, wherein the receiving apparatus:

is connected to a feed via said first interface and a unidirectional line;

is connected to a bidirectional line via said second interface and a router;

receives a packet including path control information from said router via said second interface;

capsulates the received packet and transmits the capsulated packet to said feed via said second interface, said router, and said bidirectional line; and

receives path information from said feed via said unidirectional line and said first interface.

7. An apparatus according to claim 5 or 6, wherein said packet is an IP packet.

8. An apparatus according to claim 5 or 6, wherein said unidirectional line is a satellite line.

ABSTRACT OF THE DISCLOSURE

A path control packet is sent from a router to a receiver. The receiver capsulates the received packet and transmits a capsulated IP packet to a feed via a ground line. The feed extracts the path control packet by decapsulation and transmits the packet to a router. At the same time, path control information is sent to a satellite line. The router processes the packet as if the path control information from the router reached via the satellite line. When a receiver receives a packet via the satellite line, it transmits the packet as a packet to a router. This router processes the packet as if the path control information from the router reached via the satellite line.

Fig. 1

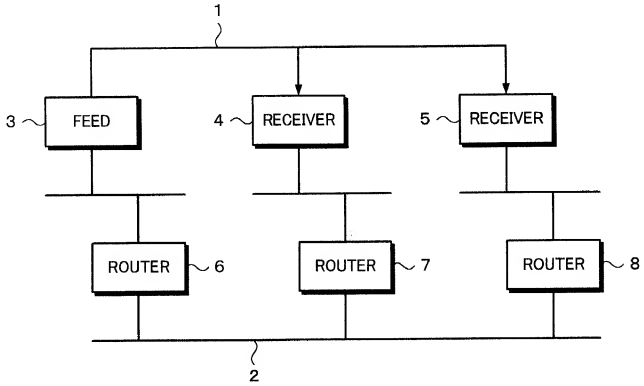


Fig. 2

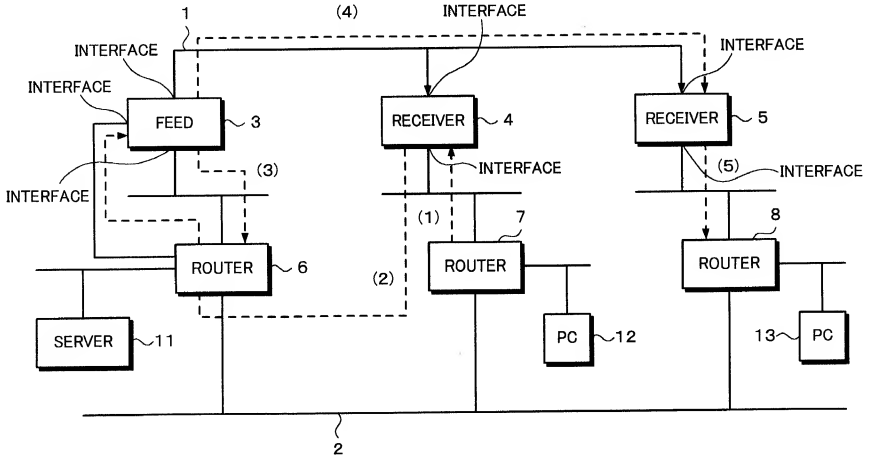
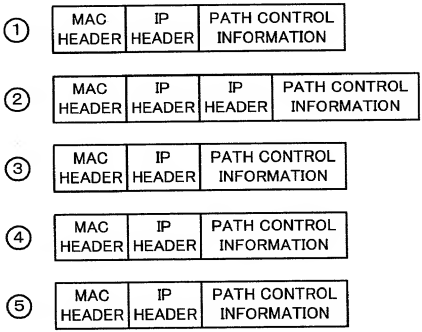


Fig. 3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MAC HEADER
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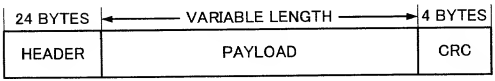
Fig. 4


24 BYTES
VARIABLE LENGTH
4 BYTES
HEADER
PAYLOAD
CRC

SUGI-T0764

BY EXPRESS MAIL NO. EL254155350US

Declaration and Power of Attorney For Patent Application
特許出願宣言書及び委任状

Japanese Language Declaration
日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。	As a below named inventor, I hereby declare that:
私の住所、私書箱、国籍は下記の私の氏名の後に記載された通りです。	My residence, post office address and citizenship are as stated next to my name.
下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者であると（下記の名称が複数の場合）信じています。 _____ _____	I believe I am the original, first and sole inventor (if only one named is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled. COMMUNICATING METHOD, TRANSMITTING APPARATUS, AND RECEIVING APPARATUS
上記発明の明細書（下記の欄でx印がついていない場合は、本書に添付）は、 ☐ __月__日に提出され、米国出願番号または特許協定条約国際出願番号を_____とし、 （該当する場合）_____ に訂正されました。	the specification of which is attached hereto unless the following box is checked: [ ] was filed on ____ as United States Application Number or PCT International Application Number ____ and was amended on _____ (if applicable).
私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。	I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.
私は、連邦規則法典第３７編第１条５６項に定義されるとおり、特許資格の有無について重要な情報を開示する義務があることを認めます。	I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.
私は、米国法典第３５編１１９条(a)-(d)項又は３６５条(b)項に基き下記の、米国以外の国の少なくとも一ヵ国を指定している特許協力条約３６５(a)項に基ずく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している、本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示しています。	I hereby claim foreign priority under Title 35, United States Code, Section 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.
Prior Foreign Application(s) 外国での先行出願	Priority Not Claimed 優先権主張なし
P11-186493 (Number) （番号）	Japan (Country) （国名）
30 June 1999 (Day/Month/Year Filed) （出願年月日）	____

Japanese Language Declaration
日本語宣言書

(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願年月日)

私は、第３５編米国法典第１１９条(e)項に基いて下記の米国特許出願規定に記載された権利をここに主張いたします。

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

(Application No.) (出願番号)	(Filing Date) (出願日)	(Application No.) (出願番号	(Filing Date) (出願日)

私は、下記の米国法典第３５編１２０条に基いて下記の米国特許出願に記載された権利、又は米国を指定している特許協力条約３６５条(c)に基ずく権利をここに主張します。また、本出願の各請求範囲の内容が米国法典第３５編１１２条第１項又は特許協力条約で規定された方法で先行する米国特許出願に開示されていない限り、その先行米国出願書提出日以降で本出願書の日本国内または特許協力条約国際提出日までの期間中に入手された、連邦規則法典第３７編１条５６項で定義された特許資格の有無に関する重要な情報について開示義務があることを認識しています。

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of application.

(Application No.) (出願番号)	(Filing Date) (出願日)	(Status: Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済)
(Application No.) (出願番号)	(Filing Date) (出願日)	(Status: Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済)

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Japanese Language Declaration
日本語宣言書

委任状： 私は下記の発明者として、本出願に関する一切の手続きを米特許商標局に対して遂行する弁理士または代理人として、下記の者を指名いたします。（弁護士、または代理人の氏名及び登録番号を明記のこと）

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